Agronomic Research

William May
AAFC
Indian Head
Questions of Interest

- Can we go beyond 12”?

- What are the implications for side-banded nitrogen fertilizers?
Experimental Design

• Split plot design with 4 reps
• Main plot: Row width
  – 10”, 12”, 14” and 16”
• Sub-plot: Nitrogen rates
  – 20, 40, 80, 120 and 160 kg N/ha
Experimental Design

• 4 Years: 2013 to 2016
• Crop: wheat (target plant population 300 plants per meter square)
• One blend of 14-20-10-10
  – 142 kg /ha (127 lbs/acre)
8 SeedMaster Openers on Two Ranks
2. Relative Seed-Fertilizer Placement

Displaced Soil

- 1.25” dent depth
- 0.75” dent depth
- 1.5” fertilizer to seed separation
- 0.75” fertilizer to seed vertical separation
# Fertilizer Products (lbs/acre)

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<th>N rate kg N/ha</th>
<th>14-20-10-10 lbs/acre</th>
<th>Urea lbs/acre</th>
<th>Total lbs/acre</th>
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Actual Urea Product per foot of Row

- **Row Spacing**
  - 10” (25 cm)
  - 12” (30 cm)
  - 14” (36 cm)
  - 16” (41 cm)

**46-0-0**

60 kg N/ha
Actual Urea Product per foot of row

Row Spacing

- **10"** (25 cm)
- **12"** (30 cm)
- **14"** (36 cm)
- **16"** (41 cm)

46-0-0

120 kg N/ha
Results
Nitrogen Rate Effects on Plant Density

Chart Title

Plant Density (plants m$^{-2}$) vs. Nitrogen fertilizer (kg ha$^{-1}$)

- 0
- 50
- 100
- 150
- 200
- 250

- 20
- 40
- 80
- 120
- 160

Nitrogen fertilizer (kg ha$^{-1}$)
Nitrogen Rate Effects on Head Density

Nitrogen fertilizer (kg ha\(^{-1}\))

Head Density (heads m\(^{-2}\))
Nitrogen Rate Effects on Seed Density

Seed Density (seeds heads\(^{-1}\)) vs. Nitrogen fertilizer (kg ha\(^{-1}\))
Nitrogen Rate Effects on Kernel Weight

Kernel Weight (g thousand kernels⁻¹)

Nitrogen fertilizer (kg ha⁻¹)
Nitrogen Rate Effects on Grain Yield

Yield (bu acre\(^{-1}\))

Nitrogen fertilizer (kg ha\(^{-1}\))
Nitrogen Rate Effects on Biomass

Biomass (kg ha\(^{-1}\))

Nitrogen fertilizer (kg ha\(^{-1}\))
Nitrogen Rate Effects on Grain Protein

Protein (%) vs. Nitrogen fertilizer (kg ha\(^{-1}\))

- 2013
- 2014
- 2015
Row Spacing Effects on Plant Density

Plant Density (plants m\(^{-2}\)) vs. Row Spacing (inches) for the years 2013 to 2016.
Row Spacing Effects on Head Density

![Graph showing the relationship between row spacing and head density with data points for years 2013 to 2016. The graph indicates a downward trend in head density as row spacing increases.]
Row Spacing Effects on Head Density

Head Density (heads m²)

Row Spacing (inches)

2014
2015
2016

Row Spacing (inches)
Row Spacing Effects on Kernel Weight

Kernel Weight (g thousand kernels⁻¹)

Row Spacing (inches)

- 2013
- 2014
- 2015
- 2016
Row Spacing Effects on Grain Yield

![Graph showing the effect of row spacing on grain yield from 2013 to 2016. The graph demonstrates a declining trend in yield as row spacing increases.]
Row Spacing Effects on Biomass

Biomass (kg ha\(^{-1}\))

Row Spacing (inches)
Row Spacing Effects on Protein

Protein (%) vs. Row Spacing (inches)

- Protein % values range from 6 to 15.
- Row Spacing values range from 10 to 16 inches.

The graph shows a trend where protein % increases with increasing row spacing.
Conclusions

• N rate had no effect on plant population indicating that fertilizer placed 1.5” to the side and ¾” below the seed is a safe configuration

• No interaction between N and row spacing

• Row spacing – one year strong decrease in yield as the row width increased past 12 inches
# Pulse Intensity in Rotation

All phases of the rotation are grown in each year 24 treatments 4 reps

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Justification

- Cereal-oilseed-pulse in a rotation
- Intensified pea-based rotation with cereal as a break crop
- Intensified broadleaf crop with 1 cereal as a break crop
- Intensified pulse-based rotation, 2 species with 1 cereal as a break crop
- Intensified pulse-based rotation, 2 species with cereal as a break crop
- Intensified canola-based rotation with cereal and pulse between
Gain Yield of Pea in Rotation in 2015

Grain Yield (bu/acre)

Low Pea
low pea Can
Two pulse
Three pulse

W-C-O-PEA
C-W-C-PEA
W-P-O-PEA
W-P-C-PEA
W-I-O-PEA
O-P-W-PEA
C-P-W-PEA
W-P-L-PEA
L-P-W-PEA
Gain Yield of Pea in Rotation in 2016

Grain Yield (bu/acre)

- Low Pea
- low pea Can
- Two pulse
- Three pulse
Gain Yield of Canola in Rotation in 2015

- O-P-W-CAN
- W-C-P-CAN
- P-C-W-CAN
- P-W-P-CAN

Grain Yield (bu/acre)

- Low Pea
- Two Canola
- Two pulse
Gain Yield of Canola in Rotation in 2016

Grain Yield (bu/acre)

- O-P-W-CAN
- W-C-P-CAN
- P-C-W-CAN
- P-W-P-CAN

Legend:
- Red: Low Pea
- Green: Two Canola
- Blue: Two pulse
Gain Yield of Wheat in Rotation in 2015

Grain Yield (bu/acre)

- Low Pea
- Low pea Can
- Two pulse
- Three pulse

C-O-P-WHEAT
C-P-C-WHEAT
P-O-P-WHEAT
P-C-P-WHEAT
L-O-P-WHEAT
P-L-P-WHEAT
Gain Yield of Wheat in Rotation in 2016

Grain Yield (bu/acre)

- Low Pea
- Low pea Can
- Two pulse
- Three pulse

Rotation Types:
- C-O-P-WHEAT
- C-P-C-WHEAT
- P-O-P-WHEAT
- P-C-P-WHEAT
- L-O-P-WHEAT
- P-L-P-WHEAT
Gain Yield of Oat in Rotation in 2015

Grain Yield (bu/acre)

- P-W-C-OAT
- P-W-P-OAT
- P-W-L-OAT

- Low Pea
- Two pulse
Gain Yield of Oat in Rotation in 2015

Grain Yield (bu/acre)

- P-W-C-OAT
- P-W-P-OAT
- P-W-L-OAT

- Low Pea
- Two pulse
## Sunflower Hybrids (Oilseed)

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* has herbicide tolerance.
# Macro and Micro Nutrient Trial

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Locations

• Indian Head — Indian Head Agricultural Research Foundation

• Swift Current - Wheatland Conservation Association

• Redvers — South East Research Farm

• Yorkton — East Central Research Foundation

• Melfort — Melfort Research Farm

• Scott — Scott Research Farm
Funding

**ADF** – Saskatchewan Ministry of Agriculture

Canaryseed Development Commission of Saskatchewan
Indian Head - 2015

Grain Yield (lb/acre)

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Melfort - 2014

Grain Yield (lb/acre)

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Grain Yield (lb/acre)

Melfort - 2015

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Scott - 2014

Grain Yield (lb/acre)

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Overall Results

• N Fertilizer: response at 14 out of 15 site-years
  Optimum amount (eyeing the trend)
  – 15 kg/ha – 1 out of 15
  – 30 kg/ha – 7 out of 15
  – 60 kg/ha – 3 out of 15
  – 90 kg/ha – 3 out of 15
Overall Results

• Chloride: response at 5 out of 15
• Phosphate: response at 1 or 2 out of 15
• Zinc: response at 1 out of 15 locations
# Foliar Micronutrients

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<th>Treatment</th>
<th>Copper</th>
<th>Zinc</th>
<th>Mn</th>
<th>Boron</th>
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**Foliar at 3-6 leaf**

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**Foliar at Flag leaf**

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Foliar Indian Head 2015

Grain Yield (lb/acre)

N, P, Cl, S

Cu
Zinc
Mn
Boron
Cu, Z, Mn, B

0.25
0.35
0.55
0.5
Yes

0
60
60
60
60
60
60
60
60
60
60
60

3 leaf
Flag leaf

0.25
0.25
0.35
0.35
0.55
0.55
0.5

Yes
Foliar Melfort 2015

Grain Yield (lb/acre)

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N, P, Cl, S

N, P, S, Cu, Z, Mn, B

Cu: 0.25  Zn: 0.35  Mn: 0.55  B: 0.5  Yes
Foliar Indian Head 2016

Grain Yield (lb/acre)

N, P, Cl, S
- 0
- 60
3 leaf
- 60
Flag leaf
- 60

Cu, Z, Mn, B
- Yes

Cu
- 0.25
- 0.35
- 0.25
- 0.35

Zinc
- 0.35
- 0.55
- 0.35
- 0.55

Mn
- 0.55
- 0.5
- 0.55
- 0.5
Aphid Populations in Canaryseed

Aphid population (Aphids/head)

Date

6-Jul-14 13-Jul-14 20-Jul-14 27-Jul-14 3-Aug-14 10-Aug-14 17-Aug-14 24-Aug-14 31-Aug-14 7-Sep-14

Aphid Populations:
- **Head**
- **Leaf Sheath**
Nitrogen, Yield and Test Weight in Oats
Nitrogen Rate and Cultivar

Test Weight (g/0.5L)

AC Assinaboia

CDC Pacer

Nitrogen Rate (kg/ha)
# Test Weight Stability

## Treatment Factors:

1) **Cultivars**

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<tr>
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<th>Redvers</th>
<th>Yorkton</th>
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<td>CDC Minstrel</td>
<td>Justice</td>
<td>CDC Dancer</td>
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<td>AC Morgan</td>
<td>Souris</td>
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<td>CDC Seabiscuit</td>
<td>CDC Morrison</td>
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2) **Nitrogen Rate (kg N ha⁻¹)**

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Nitrogen x Cultivar at Melfort in 2014

Grain Yield (bu/acre)

N Rate (lb N / acre)

Stride
AC Morgan
CDC Minstrel
CDC Seabiscuit
Nitrogen x Cultivar at Melfort in 2014

Test weight (g/0.5 L)

Stride
AC Morgan
CDC Minstrel
CDC Seabiscuit
Nitrogen x Cultivar at Melfort in 2015

![Graph showing grain yield vs. nitrogen rate for different cultivars.](image-url)
Nitrogen x Cultivar at Melfort in 2015
Nitrogen x Cultivar at Melfort in 2016

Grain Yield (bu/acre) vs N Rate (lb N / acre) for:
- Stride
- AC Morgan
- CDC Minstrel
- CDC Seabiscuit
Nitrogen x Cultivar at Melfort in 2016

![Graph showing the relationship between nitrogen rate and test weight for different cultivars. The graph includes lines for Stride, AC Morgan, CDC Minstrel, and CDC Seabiscuit, demonstrating how test weight varies with nitrogen rate.]
Nitrogen x Cultivar at Redvers in 2015
Nitrogen x Cultivar at Redvers in 2015

Test weight (g/0.5 L)

N Rate (lb N / acre)

Stride
CDC Morrison
Leggett
Souris
Nitrogen x Cultivar at Redvers in 2016

Grain Yield (bu/acre) vs N Rate (lb N / acre)

- **Stride**
- **CDC Morrison**
- **Justice**
- **Souris**
Nitrogen x Cultivar at Redvers in 2016

Test weight (g/0.5 L) vs N Rate (lb N / acre)

- Stride
- CDC Morrison
- Justice
- Souris
Early Conclusions

Rain in August stops test weight problems from occurring.

N response was often not large.

Yield potential of Individual sites had a much larger impact.

Need to complete study with analysis on probability of response to N.
Nitrogen x PGR Height in 2016

The diagram shows the relationship between nitrogen rate (kg ha\(^{-1}\)) and height (cm) for different PGR treatments: PGR 0, PGR 70, PGR 100, and PGR 130. As nitrogen rate increases, the height also increases, with PGR treatments having a moderate impact on height compared to the control (PGR 0).
Nitrogen x PGR Lodging in 2016

The graph shows the lodging score of crops at different nitrogen rates with varying PGR levels. The x-axis represents nitrogen rate (kg ha$^{-1}$), while the y-axis represents lodging score. The graph includes lines for PGR 0, PGR 70, PGR 100, and PGR 130, each with its own distinct marker. The data points indicate that lodging increases with higher nitrogen rates and different PGR levels.
Nitrogen x PGR Yield in 2016
## Barley PGR 2013

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## Barley PGR 2014

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# Barley PGR 2015

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<td>76ab</td>
<td>0.3a</td>
<td>100a</td>
<td>316a</td>
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<td>71c</td>
<td>0.2a</td>
<td>100a</td>
<td>308b</td>
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## Barley PGR 2016

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<th>Height</th>
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<th>Grain yield</th>
<th>Test weight</th>
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<td>Scale</td>
<td>bu/ac</td>
<td>g/0.5 L</td>
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<td>83.9a</td>
<td>317.0ab</td>
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</table>
Preliminary Conclusions

• Lack of lodging a real problem

• In the absence of lodging no benefit to PGR

• It will be interesting to see how much lodging occurred at other sites over the four years
Crop Sequencing of Large acreage crops and special crops

- **First year** – all eight crops are seeded in strips
- **Second year** – all eight crops are seeded across the strips set up in the first year

**Crops:**

1. Wheat
2. Oat
3. Canola
4. Pea
5. Canaryseed
6. Hemp
7. Quinoa
8. Coriander
Crop Sequencing of Large acreage crops and special crops

- **First year** – 2015, 2016, 2017
- **Second year** – 2016, 2017, 2018
- **Locations:**
  1) Swift Current
  2) Saskatoon
  3) Indian Head
  4) Melfort
Crop Sequencing of Large acreage crops and special crops

<table>
<thead>
<tr>
<th>Year A Replicate 1</th>
<th>Year B Replicate 1</th>
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<tbody>
<tr>
<td>Wheat</td>
<td>Wheat</td>
</tr>
<tr>
<td>Oat</td>
<td>Oat</td>
</tr>
<tr>
<td>Canola</td>
<td>Canola</td>
</tr>
<tr>
<td>Pea</td>
<td>Pea</td>
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<tr>
<td>Canaryseed</td>
<td>Canaryseed</td>
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<tr>
<td>Hemp</td>
<td>Hemp</td>
</tr>
<tr>
<td>Quinoa</td>
<td>Quinoa</td>
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<tr>
<td>Coriander</td>
<td>Coriander</td>
</tr>
</tbody>
</table>

104 feet 400 feet 104 feet 400 feet
Crop Sequencing of Large acreage crops and special crops

Funding

1) Government of Saskatchewan
2) Saskatchewan Wheat Development Commission
3) Western Grains Research Foundation
4) Canaryseed Development Commission of Saskatchewan
5) Prairie Oat Growers Association